Amendments to the Claims:

The word "displacement" is added for clarification and consistency of terminology in the preamble of claim 1: " . . . wherein a displacement fluid comprising . . ." In claim 13, the term "component transport rate" is amended to read "component mass transfer rate" to be consistent with similar changes made in the last office action response. In claims 14(c) and 17, the term "mass transfer" is amended to read "rate of mass transfer" or "mass transfer rate" for further consistency of terminology. Dependent claims 19 and 20 are canceled and rewritten as independent claims 21 and 22, respectively, support being found on page 17, line 25 to page 18, line 7. A listing of the claims as currently amended follows:

Listing of Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

1. (Currently Amended): A computer-implemented method for simulating one or more characteristics of a multi-component, hydrocarbon-bearing formation wherein a displacement fluid comprising at least one component is injected into the formation through at least one well to displace hydrocarbons in the formation, comprising the steps of:

(a) equating the formation in at least one dimension to a multiplicity of gridcells;

(b) dividing at least some of the gridcells into two regions, a first region representing a portion of each gridcell swept by the displacement fluid and a second region representing a portion of each gridcell essentially unswept by the injected fluid, the distribution of components in each region being essentially uniform;

(c) constructing a model representative of fluid properties within each region, fluid flow between gridcells using principles of percolation theory to provide fine-grid adverse mobility displacement behavior through functional dependencies, and principles of component mass transfer rate between regions; and

(d) using the model to simulate one or more characteristics of the formation.

2. (Previously amended): The method of claim 1 wherein step (d) predicts a property of the formation and fluids contained therein as a function of time.

3. (original): The method of claim 1 wherein the displacement fluid is miscible with hydrocarbons in the formation.

4. (original): The method of claim 1 wherein the displacement fluid is multiple-contact miscible with hydrocarbons present in the formation.

5. (original) The method of claim 1 wherein the displacement fluid is carbon dioxide.

6. (original) The method of claim 1 wherein the displacement fluid comprises hydrocarbon gas.

7. (original) The method of claim 1 wherein model constructed in step (c) is further representative of energy transport between gridcell regions.

8. (original) The method of claim 1 wherein the displacement fluid is steam and the model of step (c) is further representative of energy transport between gridcell regions.

9. (original) The method of claim 1 wherein the gridcells comprises unstructured gridcells.

10. (original) The method of claim 1 wherein the gridcells are three-dimensional.

11. (original) The method of claim 1 wherein the gridcells are two-dimensional.

12. (Previously amended): The method of claim 1 wherein the rate of mass transfer of each component is proportional to composition differences and capillary pressure differences between the two regions, and mass transfer mechanisms comprise molecular diffusion, convective dispersion and capillary dispersion.

13. (Currently amended): The method of claim 1 wherein the component mass transfer ~~transport~~ rate between regions is proportional to driving force times resistance.

14. (Currently amended): A computer-implemented method for simulating one or more characteristics of a multi-component, hydrocarbon-bearing formation into which a displacement fluid is injected to displace formation hydrocarbons present in the formation, comprising

(a) equating at least part of the formation to a multiplicity of gridcells;

(b) dividing each gridcell into two regions, a first region representing a solvent-swept portion of each gridcell and a second region representing a portion of each gridcell essentially unswept by the displacement fluid, the fluid composition within each region being essentially uniform;

(c) constructing a model comprising functions representative of mobility of each phase in each region using principles of percolation theory to provide fine-grid adverse mobility displacement behavior through functional dependencies, functions representative of phase behavior within each region, and functions representative of rate of mass transfer of each component between the regions; and

(d) using the model in a simulator to simulate production of the formation and to determine one or more characteristics thereof.

15. (Previously amended): The method of claim 14 wherein steps (a) through (d) are repeated for a plurality of time intervals and using the results to predict a property of the hydrocarbon-bearing formation and fluids contained therein as a function of time.

16. (Previously amended): A computer-implemented system for determining one or more characteristics of a multi-component, hydrocarbon-bearing formation into which a displacement fluid having at least one component is injected to displace formation hydrocarbons, said system using a multiplicity of gridcells being representative of the formation, comprising

(a) a model having each gridcell divided into two regions, a first region representing a portion of each gridcell swept by the displacement fluid and a second region representing a portion of each gridcell essentially unswept by the displacement fluid, distribution of components in each region being essentially uniform and mobility of fluids in each region being determined

based on principles of percolation theory to provide fine-grid adverse displacement behavior through functional dependencies; and

(b) a simulator, coupled to said model, to simulate the formation to determine one or more characteristics therefrom.

17. (Currently amended): The system of claim 16 wherein the model is representative of fluid properties within each region, fluid flow between gridcells, and component mass transfer rate between regions.

18. (Previously amended): A method of simulating at least one component of a multicomponent fluid system in a hydrocarbon-bearing formation, whose characterizing features are described by a set of equations, by means of a simulator on a computer, the method comprising the steps of:

(a) providing a model having each gridcell divided into two regions, a first region representing a portion of each gridcell swept by a displacement fluid and a second region representing a portion of each gridcell essentially unswept by the displacement fluid, distribution of components in each region being essentially uniform and mobility of fluids in each region being determined based on principles of percolation theory to provide fine-grid adverse mobility displacement behavior through functional dependencies; and

(b) using in the simulator the model thereby simulating changes of a component in the formation.

19. (Canceled): ~~The method of claim 1, further comprising dividing the first region into two regions, one of which represents a mixing region intermediate between swept and unswept regions.~~

20. (Cancelled): ~~The method of claim 1, further comprising dividing the second region into two regions, one of which contains a fluid different from the injected fluid, and the second of which contains none of said different fluid.~~

21. (Re-presented – formerly dependent claim 19): A computer-implemented method for simulating one or more characteristics of a multi-component, hydrocarbon-bearing formation wherein a displacement fluid comprising at least one component is injected into the formation through at least one well to displace hydrocarbons in the formation, comprising the steps of:

(a) equating the formation in at least one dimension to a multiplicity of gridcells;

(b) dividing at least some of the gridcells into three regions, a first region representing a portion of each gridcell swept by the displacement fluid, a second region representing a portion of each gridcell essentially unswept by the injected fluid, and a third region representing a mixing region of the formation's resident fluid and the injected fluid , the distribution of components in each region being essentially uniform;

(c) constructing a model representative of fluid properties within each region, fluid flow between gridcells using principles of percolation theory to provide fine-grid adverse mobility displacement behavior through functional dependencies, and principles of component mass transfer rate between regions; and

(e) using the model to simulate one or more characteristics of the formation.

22. (Re-presented – formerly dependent claim 20): A computer-implemented method for simulating one or more characteristics of a multi-component, hydrocarbon-bearing formation wherein steam is injected into the formation through at least one well to displace hydrocarbons in the formation, comprising the steps of:

(a) equating the formation in at least one dimension to a multiplicity of gridcells;

(b) dividing at least some of the gridcells into three regions, a first region representing a portion of each gridcell swept by the injected steam, a second region representing a portion of each gridcell occupied by a gas other than steam, and a third region representing a portion of each gridcell not occupied by the injected steam or the other gas, the distribution of components in each region being essentially uniform;

(c) constructing a model representative of fluid properties within each region, fluid flow between gridcells using principles of percolation theory to provide fine-grid adverse mobility displacement behavior through functional dependencies, and principles of component mass transfer rate between regions; and

(f) using the model to simulate one or more characteristics of the formation.